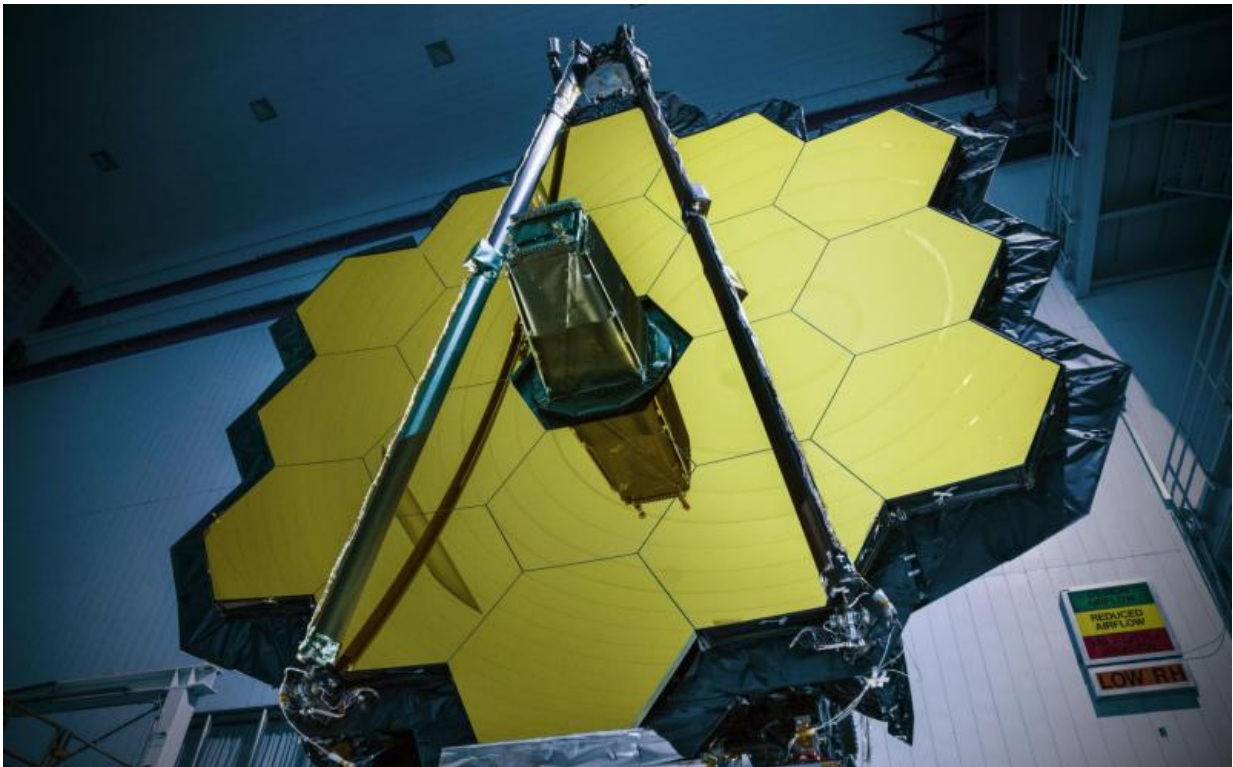


# NASA's Webb Telescope completes Goddard testing, heading to Texas for more

May 2 2017, by Laura Betz

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The James Webb Space Telescope completed its environmental testing at NASA's Goddard Space Flight Center in Greenbelt, Maryland. The Webb telescope will be shipped to NASA's Johnson Space Center in Houston for end-to-end optical testing in a vacuum at its extremely cold operating temperatures. Credit: NASA/Chris Gunn

NASA's James Webb Space Telescope has successfully passed the center

of curvature test, an important optical measurement of Webb's fully assembled primary mirror prior to cryogenic testing, and the last test held at NASA's Goddard Space Flight Center in Greenbelt, Maryland, before the spacecraft is shipped to NASA's Johnson Space Center in Houston for more testing.

After undergoing rigorous environmental tests simulating the stresses of its rocket launch, the Webb telescope team at Goddard analyzed the results from this critical optical test and compared it to the pre-test measurements. The team concluded that the mirrors passed the test with the optical system unscathed.

"The Webb telescope is about to embark on its next step in reaching the stars as it has successfully completed its integration and testing at Goddard. It has taken a tremendous team of talented individuals to get to this point from all across NASA, our industry and international partners, and academia," said Bill Ochs, NASA's Webb telescope project manager. "It is also a sad time as we say goodbye to the Webb Telescope at Goddard, but are excited to begin cryogenic testing at Johnson."

Rocket launches create high levels of vibration and noise that rattle spacecraft and telescopes. At Goddard, engineers tested the Webb telescope in vibration and acoustics test facilities that simulate the launch environment to ensure that functionality is not impaired by the rigorous ride on a rocket into space.

Before and after these environmental tests took place, optical engineers set up an interferometer, the main device used to measure the shape of the Webb telescope's mirror. An interferometer gets its name from the process of recording and measuring the ripple patterns that result when different beams of light mix and their waves combine or "interfere."

Waves of visible light are less than a thousandth of a millimeter long and

optics on the Webb telescope need to be shaped and aligned even more accurately than that to work correctly. Making measurements of the mirror shape and position by lasers prevents physical contact and damage (scratches to the mirror). So, scientists use wavelengths of light to make tiny measurements. By measuring light reflected off the optics using an interferometer, they are able to measure extremely small changes in shape or position that may occur after exposing the mirror to a simulated launch or temperatures that simulate the subfreezing environment of space.

During a [test](#) conducted by a team from Goddard, Ball Aerospace of Boulder, Colorado, and the Space Telescope Science Institute in Baltimore, temperature and humidity conditions in the clean room were kept incredibly stable to minimize fluctuations in the sensitive optical measurements over time. Even so, tiny vibrations are ever-present in the clean room that cause jitter during measurements, so the interferometer is a "high-speed" one, taking 5,000 "frames" every second, which is a faster rate than the background vibrations themselves. This allows engineers to subtract out jitter and get good, clean results on any changes to the mirror's shape.

"Some people thought it would not be possible to measure beryllium mirrors of this size and complexity in a [clean room](#) to these levels but the team was incredibly ingenious in how they performed these measurements and the results give us great confidence we have a fantastic [primary mirror](#)," said Lee Feinberg, Webb's telescope optical element manager.

The Webb [telescope](#) will be shipped to Johnson for end-to-end optical testing in a vacuum at its extremely cold operating temperatures. Then it will continue on its journey to Northrop Grumman Aerospace Systems in Redondo Beach, California, for final assembly and testing prior to launch in 2018.

The James Webb Space Telescope is the world's most advanced [space](#) observatory. This engineering marvel is designed to unravel some of the greatest mysteries of the universe, from discovering the first stars and galaxies that formed after the big bang to studying the atmospheres of planets around other stars. It is a joint project of NASA, ESA (the European Space Agency) and the Canadian Space Agency.

**More information:** For more information about the Webb Telescope mirrors, visit [www.jwst.nasa.gov](http://www.jwst.nasa.gov)

Provided by NASA

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